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EXAMINER

NADAV, D

ART UNIT

PAPER NUMBER

2811

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**Please find below and/or attached an Office communication concerning this application or proceeding.**

**Commissioner of Patents and Trademarks**

# Office Action Summary

Application No.  
08/965,286

Applicant(s)  
Gomi et al.

Examiner  
ORI NADAV

Group Art Unit  
2811



☒ Responsive to communication(s) filed on Feb 12, 2001

☒ This action is **FINAL**.

☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

A shortened statutory period for response to this action is set to expire 3 month(s), or thirty days, whichever is longer, from the mailing date of this communication. Failure to respond within the period for response will cause the application to become abandoned. (35 U.S.C. § 133). Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

## Disposition of Claims

☒ Claim(s) 1, 3, 4, 6, 17, and 19-23 is/are pending in the application.

Of the above, claim(s) \_\_\_\_\_ is/are withdrawn from consideration.

☐ Claim(s) \_\_\_\_\_ is/are allowed.

☒ Claim(s) 1, 3, 4, 6, 17, and 19-23 is/are rejected.

☐ Claim(s) \_\_\_\_\_ is/are objected to.

☐ Claims \_\_\_\_\_ are subject to restriction or election requirement.

## Application Papers

☐ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

☒ The drawing(s) filed on Nov 6, 1997 is/are objected to by the Examiner.

☒ The proposed drawing correction, filed on Feb 12, 2001 is ☒ approved ☐ disapproved.

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. § 119

☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

☐ All ☐ Some\* ☐ None of the CERTIFIED copies of the priority documents have been  
☐ received.

☐ received in Application No. (Series Code/Serial Number) \_\_\_\_\_.

☐ received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

\*Certified copies not received: \_\_\_\_\_

☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

## Attachment(s)

☐ Notice of References Cited, PTO-892

☐ Information Disclosure Statement(s), PTO-1449, Paper No(s). \_\_\_\_\_

☐ Interview Summary, PTO-413

☐ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Notice of Informal Patent Application, PTO-152

--- SEE OFFICE ACTION ON THE FOLLOWING PAGES ---

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## **DETAILED ACTION**

### ***Drawings***

1. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, a device comprising a third embedded diffusion layer being separated from the substrate by a separating diffusion layer, as recited in claim 17, must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

### ***Claim Rejections - 35 USC § 112***

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claims 17 and 21 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

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4. There is no support in the specification for a device comprising third embedded diffusion layer being separated from the substrate by a separating diffusion layer, as recited in claim 17.

5. There is no support in the specification for an impurity concentration of the second embedded diffusion layer being approximately equal to or higher than that of the epitaxial layer at all distances from the datum surface of the substrate beyond the peak position of the impurity concentration of the second embedded diffusion layer, as recited in claim 21. Figure 7 clearly depicts an impurity concentration of the second embedded diffusion layer 151 being less than that of the epitaxial layer 112 at some distances from the datum surface of the substrate beyond the peak position of the impurity concentration of the second embedded diffusion layer.

6. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

7. Claims 17, 21 and 23 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

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8. The claimed limitations of a third embedded diffusion layer being separated from the substrate by a separating diffusion layer, as recited in claim 17, is unclear as to where the third embedded diffusion layer is located.

9. The claimed limitation of an impurity concentration of the second embedded diffusion layer being approximately equal to or higher than that of the epitaxial layer at all distances from the datum surface of the substrate beyond the peak position of the impurity concentration of the second embedded diffusion layer, as recited in claim 21, is unclear as to which side of the 'peak position' the term 'beyond' refers.

10. The claimed limitation of a first vertical type bipolar transistor defining a voltage that is different than the a second vertical type bipolar transistor, as recited in claim 23, is unclear as to how a voltage can be different from a transistor.

### ***Claim Rejections - 35 USC § 102***

11. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

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12. Claims 1, 3, 4 and 19-20 are rejected under 35 U.S.C. 102(b) as being anticipated by Kumamaru et al. (4,379,726) or Watanabe et al. (4,258,379).

Kumamaru et al. teach in figure 10 a semiconductor device comprising a silicon substrate 1, 5 defining a datum bottom surface, an epitaxial layer 11 formed on the substrate above the datum surface, a first embedded diffusion layer 14 formed as part of a first vertical bipolar transistor 15 in a first upper part of the substrate and has the same conductivity type and higher impurity concentration than that of the epitaxial layer, a second embedded diffusion layer 5a (figure 8) formed as part of a second vertical type transistor 13 in a second upper part of the substrate and having the same conductivity type as the epitaxial layer and having an impurity concentration less than the impurity concentration of the first embedded diffusion layer 14 and is approximately equal to or higher than the impurity concentration of the epitaxial layer (column 3, lines 16 and 27-28), wherein peak positions of impurity concentrations of the first and second embedded diffusion layers reside at first and second distances from the datum surface of the substrate, such that the first distance is greater than the second distance.

Watanabe et al. teach in figure 8 a semiconductor device comprising a silicon substrate 1 defining a datum bottom surface, an epitaxial layer 3 formed on the substrate above the datum surface, a first embedded diffusion layer 21 formed as part of a first vertical

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bipolar transistor 101 in a first upper part of the substrate and has the same conductivity type and higher impurity concentration than that of the epitaxial layer, a second embedded diffusion layer 22" formed as part of a second vertical type transistor 201 in a second upper part of the substrate and having the same conductivity type as the epitaxial layer and having an impurity concentration less than the impurity concentration of the first embedded diffusion layer 14 and is approximately equal to or higher than the impurity concentration of the epitaxial layer (figure 9), wherein peak positions of impurity concentrations of the first and second embedded diffusion layers reside at first and second distances from the datum surface of the substrate, such that the first distance is greater than the second distance.

Regarding claim 3, prior art teach a first embedded diffusion layer is formed at a larger distance from the datum surface than the second embedded diffusion layer.

Regarding claim 4, prior art teach a second embedded diffusion layer having a impurity concentration at least equal to that of the epitaxial layer.

Regarding claims 19 and 20, prior art teach a second embedded diffusion layer and an epitaxial layer being an effective collector layers.

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***Claim Rejections - 35 USC § 103***

13. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

14. Claims 1, 3, 4, 19-20 and 6, 21, 23, insofar as in compliance with 35 U.S.C. 112, are rejected under 35 U.S.C. 103(a) as being unpatentable over Kumamaru et al. or Watanabe et al.

Kumamaru et al. and Watanabe et al. teach substantially the entire claimed structure, as applied to claim 1 above, except a second embedded diffusion layer having an impurity concentration of  $10E13$  to  $10E15$ .

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use a second embedded diffusion layer having an impurity concentration of  $10E13$  to  $10E15$  in Kumamaru et al. and Watanabe et al.'s devices, since it is a matter of design choice within the skills of an artisan, subject to routine experimentation and optimization.

Regarding claim 21, Kumamaru et al. and Watanabe et al. teach an impurity concentration of the second embedded diffusion layer being approximately equal to or higher than that of the epitaxial layer at all distances from the datum surface of the



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substrate beyond the peak position of the impurity concentration of the second embedded diffusion layer.

Regarding claim 23, Kumamaru et al. and Watanabe et al. teach a first vertical type bipolar transistor defining a voltage that is different than that of the second vertical type bipolar transistor, wherein the first embedded diffusion layer having an impurity concentration that is higher than that of the epitaxial layer.

15. Claim 17, insofar as in compliance with 35 U.S.C. 112, is rejected under 35 U.S.C. 103(a) as being unpatentable over Kumamaru et al. or Watanabe et al. in view of Takemoto et al. (4,826,780).

Kumamaru et al. and Watanabe et al. teach substantially the entire claimed structure, as applied to claim 1 above, except a separating diffusion layer formed in the substrate and separating the substrate from a third embedded diffusion layer having an opposite conductivity type to the epitaxial layer.

Takemoto et al. teach in figure 13 a first vertical transistor, a second vertical NPN transistor and a third vertical transistor formed on the substrate, wherein the third vertical transistor having a separating diffusion layer 32 formed in the substrate and separating the substrate 31 from a third embedded diffusion layer 36 having an opposite conductivity type to the epitaxial layer. It would have been obvious to a

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person of ordinary skill in the art at the time the invention was made to form a third vertical transistor on the substrate in Kumamaru et al. and Watanabe et al.'s device, because it is well known in the art to form plurality of transistors of one semiconductor substrate in order to reduce the size of the device. The type of devices which are being formed depend on the requirements of the application in hand.

16. Claim 22, is rejected under 35 U.S.C. 103(a) as being unpatentable over Kumamaru et al. or Watanabe et al. in view of Admitted Prior Art (APA).

Kumamaru et al. and Watanabe et al. teach substantially the entire claimed structure, as applied to claim 1 above, except a peak position of an impurity concentration of the second embedded diffusion layer resides at a distance from the datum surface that is approximately equal to a location of the bottom of the first embedded diffusion layer from the datum surface.

APA teaches in figures 3 and 4 a peak position of an impurity concentration of the second embedded diffusion layer residing at a distance from the datum surface that is approximately equal to a location of the bottom of the first embedded diffusion layer from the datum surface.

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to form the peak position of an impurity concentration of the second embedded diffusion layer at a distance from the datum surface that is

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approximately equal to a location of the bottom of the first embedded diffusion layer from the datum surface in Kumamaru et al. and Watanabe et al.'s device, since it is a matter of design choice within the skills of an artisan, subject to routine experimentation and optimization.

### ***Response to Arguments***

17. Applicant argues on page 7 that there is support in the specification for the device recited in claim 17, because applicant is entitled to claim any features which are taught or suggested in the specification.

The specification of the present invention comprises various embodiments, i.e. various inventions. Applicant can not pick and choose elements from one embodiment and combine them with elements of another embodiment, because a new device, which was not described in the specification, is formed.

18. Applicant argues on page 9 that Watanabe et al. do not teach a first embedded diffusion layer 21 being a part of a first vertical type bipolar transistor, because figure 9 relates to the second vertical bipolar transistor.

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Although figure 9 depicts the second vertical bipolar transistor, figure 8 clearly depicts the first embedded diffusion layer 21 being a part of a first vertical type bipolar transistor 101, as claimed.

19. Applicant argues on pages 10-11 that although Watanabe et al. teach in figure 8 a second embedded diffusion layer being deeper than the first embedded diffusion layer, prior art does not teach a first distance of the first embedded diffusion layer being greater than the second distance of the second embedded diffusion layer

Figure 10 of Kumamaru et al. and figure 8 of Watanabe et al. clearly depict a second embedded diffusion layer being deeper than the first embedded diffusion layer, thus rendering the first distance of the first embedded diffusion layer being greater than the second distance of the second embedded diffusion layer. Furthermore, applicant admits that the second embedded diffusion layer is located deeper than the first embedded diffusion layer (page 10, last sentence). Thus, the first distance is greater than the second distance, as claimed.

20. Applicant argues on page 12 that using a second embedded diffusion layer having an impurity concentration of  $10^{13}$  to  $10^{15}$  in Kumamaru et al. and Watanabe et al.'s devices, is not a matter of design choice within the skills of an artisan, subject to routine experimentation and optimization.

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Generally, differences in concentration or temperature will not support the patentability of subject matter encompassed by the prior art unless there is evidence indicating such concentration or temperature is critical. "[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." *In re Aller*, 220 F.2d 454, 105 USPQ 233, 235 (CCPA 1955). See also *In re Hoeschele*, 406 F.2d 1403, 160 USPQ 809 (CCPA 1969). For more recent cases applying this principle, see *Merck & Co. Inc. v. Biocraft Laboratories Inc.*, 874 F.2d 804, 10 USPQ2d 1843 (Fed. Cir.), cert. denied, 493 U.S. 975 (1989), and *In re Kulling*, 897 F.2d 1147, 14 USPQ2d 1056 (Fed. Cir. 1990).

21. Applicant argues on page 14 that Kumamaru et al. do not teach the impurity concentration of the second embedded diffusion layer 5a being approximately equal to or higher than that of the epitaxial layer 11.

Kumamaru et al. do not explicitly state the impurity concentration of the second embedded diffusion layer 5a. However, Kumamaru et al. teach that the impurity concentration of the second embedded diffusion layer 5a is n-, and the impurity concentration of the epitaxial layer 11 is also n- (column 3, lines 16 and 27-28). Therefore, the impurity concentration of the second embedded diffusion layer 5a is

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approximately equal to or higher than the impurity concentration of the epitaxial layer, as claimed.

### ***Conclusion***

22. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

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**Papers related to this application may be submitted to Technology center (TC) 2800 by facsimile transmission. Papers should be faxed to TC 2800 via the TC 2800 Fax center located in Crystal Plaza 4, room 4-C23. The faxing of such papers must conform with the notice published in the Official Gazette, 1096 OG 30 (November 15, 1989). The Group 2811 Fax Center number is (703) 308-7722 and 308-7724. The Group 2811 Fax Center is to be used only for papers related to Group 2811 applications.**

Any inquiry concerning this communication or any earlier communication from the Examiner should be directed to *Examiner Nadav* whose telephone number is **(703) 308-8138**. The Examiner is in the Office generally between the hours of 7 AM to 4 PM (Eastern Standard Time) Monday through Friday.

Any inquiry of a general nature or relating to the status of this application should be directed to the **Technology Center Receptionists** whose telephone number is **308-0956**

Ori Nadav, Ph.D.

March 5, 2001

*William Mintel*  
**William Mintel**  
**Primary Examiner**  
**Art Unit 2811**